Reproductive and Birth Outcomes: Prematurity

Type of EPHT Indicator	Health Outcome
Measure	1. Average annual number of very preterm (less than 32 weeks gestation) live singleton births over 5 year period 2. Average annual percent of very preterm (less than 32 weeks gestation) live singleton births over 5 year period 3. Number of preterm (less than 37 weeks gestation) live singleton births 4. Percent of preterm (less than 37 weeks gestation) live singleton births
Derivation of Measure	1. Number of live singleton births before 37 weeks of gestation to resident mothers, divided by total number of live singleton births to resident mothers 2. Number of live singleton births before 32 weeks of gestation to resident mothers, divided by total number of live singleton births to resident mothers
Unit	1. Preterm live singleton births 2. Very preterm live singleton births
Geographic Scope	Iowa
Geographic Scale	County and state
Time Period	2000- Most Recent Year Available
Time Scale	Calendar year and 5 Year period
Rationale	**Significance/Background:** Preterm birth (at less than 37 completed weeks of gestation and among all births regardless of plurality) affects more than 500,000, or 12.5%, of live births in the United States and is a leading cause of infant mortality and morbidity (9,10,14). Of those births, the majority (about 84%) of premature babies are born *moderately preterm* (between 32 and 36 completed weeks of gestation). The remaining 16% of those are born *very preterm* (at less than 32 weeks of gestation), representing more than 80,000, or 2%, of live births in the United States. Of those infants born very preterm, about 63% are born between 28–31 weeks of gestation, and about 37% are born at less than 28 weeks of gestation. The preterm birth rate rose 18% between 1990 and 2004 (from 10.6% in 1990 to 12.5% in 2004) and more than 30% since 1981 (from 9.4%) (10). For 2003–004, increases were seen among both moderately preterm and very preterm births. The percentage of infants born very preterm increased from 1.92% to 2.01% between 1990 and 2004 (10); it also increased between 2003 and 2004 from 1.97% to 2.01%, respectively. Preterm birth rates are higher among black mothers compared to Hispanic and white mothers. Between 2002 and 2003, the rates increased for the three largest race and ethnic groups: non-Hispanic white (11.0 to 11.3%), non-Hispanic black (17.7 to 17.8%), and Hispanic (11.6 to 11.9 %) (10). Since 1990, preterm birth rates have risen by one-third (about 33%) for non-Hispanic white births (from 8.5%) and by 8% for Hispanic births (11.0%). In contrast, preterm rates among non-Hispanic black infants have declined slightly over this period (from 11.9%). However, the preterm birth risk of non-Hispanic blacks continues to be substantially higher that the risk of other race and ethnic groups. Of particular concern is the very preterm rate, about twice as high among non-Hispanic black infants compared to non-Hispanic white and Hispanic births (3.99% compared to 1.6% and 1.73%, respectively).

Preterm birth is a leading cause of infant mortality, morbidity, and long-term disability (9,10,14,15). All infants born preterm are at risk for serious health problems; however, the earlier an infant is born, the greater the risk of medical complications, long-term disabilities, and death.

Studies have shown that infants born prematurely, especially those with VLBW, have an increased risk for neurological problems ranging from attention deficit hyperactivity disorder to cerebral palsy or mental retardation compared with infants born at term gestation (1,6,9,15). Preterm birth is associated with nearly half of all congenital neurological defects such as cerebral palsy (10); it is also associated with congenital gastrointestinal defects such as gastroschisis.

Preterm infants are at greater risk for serious health problems for several reasons: the earlier an infant is born, the less it will weigh, the less developed its organs will be, and the more medical complications it will likely face later in life. Very preterm infants have the greatest risk of death and lasting disabilities, including mental retardation, cerebral palsy, respiratory (premature lung) and gastrointestinal problems (including birth defects such as gastroschisis), and vision and hearing loss. Preterm births account for health care expenditure of more than $3 billion per year (15).

Studies have shown that major risk factors associated with preterm birth include (2,4,7,9,11,15):

- Plural births
- Previous preterm birth
- Certain uterine or cervical abnormalities of the mother
- Mother's age, race, poverty (for example, Black women, women younger than 17 and older than 35 years, and poor women are at greater risk than other women)
- Male fetal gender (associated with singleton preterm birth)
- Certain lifestyles and environmental factors, including:
    - Late or no prenatal care,
    - Maternal smoking, alcohol consumption (especially in early pregnancy), illegal drug use, exposure to the medication diethylstilbestrol (DES), domestic violence, lack of social support, stress, long working hours with long periods of standing, being underweight before pregnancy, obesity, marital status, and spacing (less than 6– months between giving birth and the beginning of the next pregnancy),
    - Neighborhood-level characteristics,
    - Environmental contaminants (e.g., exposure to air pollution and drinking water contaminated with chemical DBP or lead).

Certain medical conditions during pregnancy (e.g., infections, diabetes, hypertension, blood clotting disorders/thrombophilia, vaginal bleeding, certain birth defects of the fetus, being pregnant with a single fetus after in vitro fertilization) may also increase the risk of preterm birth.

The strength of the association of each of these risk factors with preterm birth varies, and remains a subject of significant debate in the literature (15).

The rise in the occurrence of multiple/plural births, which are much more likely than singleton births to be preterm, influenced the overall preterm birth rate over the past two decades. However, preterm rates for singleton births have also increased, up to 11% since 1990 (10). This increase in singleton preterm births was only in infants born moderately preterm; the singleton very preterm birth rate declined slightly, from 1.69% in 1990 to 1.61% in 2004.

Infants weighing less than 1,500 grams, or 3 pounds, 4 ounces, at birth are considered VLBW (3); most of them are also premature (born before 37 weeks gestation). (Note that the percent of VLBW babies among all births is also confounded by plurality; therefore, the percent of

	VLBW births among singleton births is recommended as a population-level measure of prematurity.) Studies have shown that the infant' birthweight is a predictor of future morbidity and mortality (10), especially for VLBW infants. VLBW infants have about a 25% chance of dying in the first year of life; this risk is estimated to be about 100 times higher for VLBW infants than for normal-weight infants (?,500grams) (10). VLBW infants have an increased risk for developing neurological and intellectual problems (including attention deficit hyperactivity disorder, cerebral palsy, developmental delay and mental retardation), visual problems (including blindness), hearing loss, infections, and chronic lung diseases compared with infants of normal weight or infants born at term gestation (1,6,8,9). Nationally, the percentage of VLBW infants (regardless of plurality) increased slightly from 1.45% in 2003 to 1.49% in 2005, and has increased from 1.27% in 1990 (6). The 2005 rate is 66% higher than the Healthy People 2010 goal of 0.9% (6). The VLBW has increased since 1990 among whites, blacks, Puerto Ricans, American Indians, and other population groups (6). For 2004–005, increases in VLBW rates were statistically significant for non-Hispanic black infants but not for non-Hispanic white infants (10). The increase in the rate of multiple births, in which the infants tend to be much smaller than in singleton births, has likely affected the upward trend in the VLBW rate (10). However, the VLBW rate among singleton births also increased slightly from 1.12% in 2004 to 1.14% in 2005 (10). Increases in obstetric interventions (e.g., induction of labor and cesarean delivery), teenage pregnancy, and older maternal age at childbearing likely contributed to the increased VLBW rates. Teen mothers, especially those younger than aged 15 years, have a higher chance of giving birth toa VLBW infant. Environmental exposures, including exposure to air pollution, drinking water contaminated with chemical DBP, and exposure to pesticides, have also been implicated as possible risk factors for VLBW, but the exact magnitude of the contribution to the increased VLBW rates remains relatively uncertain. **Rationale:** Preterm birth and birthweight are multifactorial and heterogeneous birth outcomes. Birthweight of an infantbaby is directly related to its gestational age. As noted above, VLBW is strongly associated with prematurity, and many infants of multiple births are VLBW. Therefore, the percentage of VLBW births is recommended as an indicator of prematurity, and the measure is restricted to singleton infants only. As such, the measure distinguishes between multiple birth categories and decreased fetal growth that may be affected by other factors, including environmental factors. Preterm and VLBW births are associated with manymodifiable risk factors, and prevention of preterm and VLBW births may greatly contribute to the overall reduction in infant illness, disability, and death. Several studies are being conducted to improve our understanding of the precise causes of preterm births, especially those with VLBW, and to learn how to prevent them. These studies look at how genes, maternal stress, race, occupational and environmental factors, and infections may contribute to preterm birth and VLBW (9). Better understanding of the specific causes of preterm and VLBW births is needed before tailored interventions can be developed. Neighborhood-level characteristics have proven to be useful predictors of preterm and VLBW birth risks (11). Neighborhoods are the geographic units where interventions can be targeted, and those interventions can be an effective way to reduce preterm and VLBW birth rates and other adverse birth outcomes. Neighborhood-level characteristics contributing to prematurity and VLBW include the social, economic, and environmental risk factors such as certain aspects of the built environment. Preterm and VLBW births data are readily available in all state health departments and can be used to examine trends. These trends may reflect the contributions of environmental

	exposures and other modifiable risks to preterm and VLBW births. These trends can also be used to evaluate the effectiveness of existing and new prevention programs.
Use of the Measure	This indicator can be utilized to enhance public health prevention actions and interventions, and inform policy makers and the public regarding risk factors management and mitigation.
Limitations of the Measure	**Uncertainties associated with gestational age estimates:** The interval between the first day of the mother's last normal menstrual period (LMP) and the day of birth is one method used to determine the gestational age of the newborn. However, this measurement is subject to error for many reasons, including imperfect maternal recall or misidentification of the LMP due to postconception bleeding, delayed ovulation, or intervening early miscarriage (10). Thus, for the purpose of calculating national statistics of preterm births, these data are being edited for gestational ages that are clearly inconsistent with the infant's plurality and birth weight, but substantial inconsistencies in the data still persist (10). The National Center for Health Statistics (NCHS) and most state vital records offices report gestational age based on an algorithm that uses both the mother's reported last normal menses and the clinician's estimate of gestational age. The LMP indicator is used unless its value appears to be inconsistent with birthweight, falls outside likely parameters, or was not reported. If any of these circumstances exist, the clinical estimate is used. Nationwide in 2004, approximately 5.9% of gestational age values were based on the clinical estimate (10). Changes in reporting of the gestational age over time may affect trends in preterm birth rates, especially by race (10). These reporting problems may occur more frequently among some subpopulations and among births with shorter gestations. **Difficulties of interpreting preterm and very preterm birth rates:** The preterm birth rates might be an indicator of pregnancy outcome that does not accurately predict the true health risk associated with early birth. Preterm rates based on live singleton births may be affected by maternal characteristics; a low preterm birth rate might indicate a low-risk population, and a high preterm birth rate might indicate maternal characteristics that predispose to preterm birth. **Difficulties of interpreting VLBW birth rates:** Although the percentage of VLBW births has increased during the past 20 years, in large part this could be due to improvements in fetal health. Conditions that may have resulted in a fetal death decades ago might today result in fetal survival and a live VLBW birth (8). **Recommendations:** The preterm, very preterm, and VLBW birth rates should be interpreted with caution, and ideally the NCHS algorithm should be used in presenting gestational age. These birth rates should not be the only reproductive outcome measures being monitored; they should be accompanied by the infant mortality rate (neonatal and postneonatal), fetal death rate, and morbidity measures. If feasible, a newborn's anthropometric parameters should also be monitored; this could include a reduced head circumference measure because smaller head size may be predictive of lower IQ and cognitive abilities and may be associated with ADD/ADHD. These measures include only live singleton preterm and VLBW births. Proportions of preterm, very preterm, and VLBW births among live multiple birth categories may also be informative measures.
Data Sources	Iowa Department of Public Health vital statistics systems (birth, death, and fetal death records)
Limitations of the Data Sources	Vital statistics data are readily available, of high quality, and useful for various purposes, including public health surveillance; however, they cannot be correctly interpreted unless various qualifying factors and classification methods are considered (see "Appropriate Use of the Measure"). The factors to be considered will vary depending on the intended use of the

	data; however, most of the limiting factors result from imperfections in the original records, and they should not be ignored. Yet, their existence does not lessen the value of the data for calculating/estimating this measure. The credibility of gestational age estimates should be examined. At the minimum, the following data quality attributes should be evaluated: reporting and quality control procedures, records geocoding procedures and quality, etc. One important limitation of the data is the speed at which data are available. Due to the normal functioning of the Vital Records system, it can sometimes takes weeks or even months after the end of a particular month before all births that occurred during that month are sent to Vital Records by the hospitals and processed. This is particularly the case for resident births that occur out of state. These process issues, along with the need to close off national statistics at specified intervals after a reporting period, may lead to small discrepancies between national data compiled by NCHS and data maintained by state vital statistics registries.
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